

**CITY OF GALVESTON, TEXAS  
BROWNFIELDS SITE ASSESSMENT PILOT PROJECT**

**QUALITY ASSURANCE PROJECT PLAN  
AND FIELD SAMPLING PLAN  
FOR THE**

**CITY OF GALVESTON MATERIALS YARD  
GALVESTON, TEXAS**

**DRAFT FOR REVIEW**

**Prepared for**

**U.S. Environmental Protection Agency  
Dallas, TX 75202-2733**

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**179646**

## ABBREVIATIONS AND ACRONYMS

%R	Percent recovery
ASTM	American Society for Testing and Materials
BERI	Brownfields Economic Redevelopment Initiative
bgs	Below ground surface
BSAPP	City of Galveston Brownfields Site Assessment Pilot Project
CLP	Contract Laboratory Program
Cwm	Clear wide-mouth bottle
DQA	Data quality assessment
DQO	Data quality objective
EPA	U.S. Environmental Protection Agency
FID	Flame Ionization Detector
FSP	Field sampling plan
IDW	Investigation-derived waste
MAG	Meridian Alliance Group
MDL	Method detection limit
MS	Matrix spike
MSD	Matrix spike duplicate
NIOSH	National Institute for Occupational Safety and Health
ORD	U.S. EPA Office of Research and Development
OSWER	U.S. EPA Office of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyl
PM	Program manager
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QMP	Quality management plan
RAC	Response Action Contract
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
SOP	Standard operating procedure
SPLP	Synthetic Precipitation Leaching Procedure
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCEQ	Texas Commission on Environmental Quality
UST	Underground storage tank
VCP	Voluntary Cleanup Program
VOC	Volatile organic compounds
WAM	Work assignment manager

**A1 TITLE AND APPROVAL SHEET**

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**A3 DISTRIBUTION LIST**

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**Subcontractors:**

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Analytical Laboratory – Environmental Chemistry, Inc.  
Data Quality Validation – Environmental Chemistry Services

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Name Title: Mike Frew  
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#### A4 PROJECT AND TASK ORGANIZATION

The City of Galveston, Texas' Brownfields Site Assessment Pilot Project (BSAPP) has selected the property known as the City of Galveston Materials Yard for an Environmental Site Assessment. BSAPP's project coordinator for this project is Meridian Alliance Group, LLC. (MAG). Specifically MAG will provide personnel, services, materials, and equipment required for sampling and analytical support. On the basis of the analytical results, MAG will make recommendations regarding the need for additional investigation and or remedial alternatives.

EPA requires that all environmental monitoring and measurement efforts mandated or supported by EPA be subject to a centrally managed quality assurance (QA) program. Any party that generates data under the QA program is responsible for implementing minimum procedures to ensure that the precision, accuracy, completeness, sensitivity, comparability, and representativeness of its data are known and documented. To ensure that this responsibility is met, each party must prepare a quality assurance project plan (QAPP) and field sampling plan (FSP) for each environmental data collection effort that it is contracted to complete.

This QAPP and FSP present the overall project description, project organization and responsibilities, and QA objectives associated with sampling and analytical services that will be conducted in support of the City of Galveston Materials Yard. This project-specific QAPP and FSP were prepared in accordance with the format outlined in, and complies with all requirements of, EPA Requirements for Quality Assurance Project Plans (U.S. EPA QA/R-5 – March 2001).

This QAPP and FSP were prepared to provide general guidance for collecting and analyzing environmental samples during this site study.

The objectives, procedures, and techniques described in this document are intended to provide general guidance for a rapid assessment of current environmental conditions at the City of Galveston Materials Yard Site. MAG has based this QAPP and FSP on a site specific Phase I Environmental Site Assessment (ESA), review of existing Site information, and on preliminary site visits conducted in December 2003. The site-specific FSP will be used as part of this QAPP.

MAG will perform all tasks under this work assignment in accordance with Standard Operating Procedures contained in Appendix A. Mr. James W. (Win) Turner is BSAPP's / MAG's Project Coordinator and Mr. Ronald B. Schultz is the Quality Assurance Officer. Mr. Turner and Mr. Schultz are responsible for the quality of work conducted by MAG and its subcontractors. Mr. Win Turner (MAG) is also the project manager for this work assignment. The project manager is responsible for implementing all activities required by the work assignment.

The final Report will be issued to the potential data users and decision makers that include the City of Galveston, EPA, the TCEQ, and Private Developers (with the City's approval). The project organization chart is shown in Figure A-1.

#### A5 PROBLEM DEFINITION AND BACKGROUND

The main objectives of this work assignment, under the BSAPP are:

Develop and implement a field-sampling plan to determine if contamination in the soil and shallow

groundwater is present; and if necessary, develop a corrective action plan and remediation cost estimate for the Site. The extent of remediation will be based on the planned future use of the site and associated risk levels of the constituents of concern at the site.

#### **A5.1 BACKGROUND OF BROWNFIELDS ECONOMIC REDEVELOPMENT INITIATIVE (BERI)**

This section provides general background information on the EPA Region 6 BERI. BERI is designed to empower states, communities, and other stakeholders to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse Brownfields. A Brownfield is a site, or portion thereof, on which there is actual or perceived contamination and that has potential for redevelopment or reuse. BERI was established to remove the environmental and institutional barriers that prevent the beneficial reuse of Brownfield properties.

The City of Galveston, Texas was awarded a Brownfields pilot grant from the U.S. EPA in September 1998. This particular assessment will proceed under a supplemental attachment to the previously mentioned grant from September of 1998. The Brownfields Site Assessment Pilot Project (BSAPP) has identified the City of Galveston Materials Yard as a potential Brownfield Site.

#### **A5.2 SITE BACKGROUND**

The Site is generally characterized as the City of Galveston Materials Yard. The Site is approximately 9-acres and is located at 83<sup>rd</sup> and Cessna Drive, Galveston, Texas. The city of Galveston's Public Works Department presently uses the Site for disposal of construction debris, storm sewer cleaning sludge, and road construction raw material storage. Additionally, the Galveston Police Department uses a portion of the Site for stables and horse pasture. Historically the Site was part of the Scholes International Airport properties. The site location is shown on Figure A-2.

The Site history is listed below:

- 1931-1942 Galveston Municipal Airport and vacant land
- 1943-1945 Galveston Army Airfield and Vacant Land
- 1946-Present Municipal Airport, vacant land, and currently the Materials Yard

The Site has been vacant land until it became the Public Works Department's Materials Yard in 1986. The Public Works Department has used the Site for storing pre-cast concrete storm sewer pipe and fittings, wood pilings, asphalt, gravel, crushed concrete, and various types of construction debris and fill material.

#### **PREVIOUS ENVIRONMENTAL STUDIES**

The following list summarizes the environmental and related investigations and studies that have been performed at the subject property.

- MAG has recently completed (December 2003) a Phase I Environmental Assessment on the Materials Yard Site that is owned by the City of Galveston.

### A5.3 EXISTING SITE CONDITIONS

The Phase I ESA revealed evidence of recognized environmental conditions of concern. These include:

- There are several hundred cubic yards of construction debris, fill material, other debris, and storm sewer cleaning sludge. The specific sources for these materials are unknown, but potential contaminants are suspected, especially in connection with the storm sewer cleaning sludge.
- A truck washout area is present on-site. This is used to clean the sewer cleaning vacuum trucks and should be investigated.
- The horse pasture has large areas that reportedly will not support any vegetation and should be sampled for possible contamination,
- A small are of potential wetlands exits in the southwest portion of the site.
- A drainage canal cuts through the southwest portion of the site and should be sampled for possible contamination.

### A6 PROJECT AND TASK DESCRIPTION

This section describes the project objectives and tasks for this QAPP and FSP.

#### A6.1 OBJECTIVES

The main objectives of this work assignment are:

- to research previous site data;
- implement a field sampling plan to determine if contamination in the soil, shallow groundwater, surface water and sediment is present;
- determine the volume of material; and
- if necessary, develop a corrective action plan and remediation cost estimate for the Site. The extent of remediation will be based on the planned future use of the site and associated risk levels of the constituents of concern at the site.

To achieve these goals, soil, groundwater, surface water and sediment samples will be collected to identify whether contamination is present at levels exceeding regulatory risk levels.

If remediation is required, before this Site can be developed, MAG will provide recommendations concerning (1) determination of the horizontal and vertical extent of soil contamination, (2) determination of groundwater contaminant levels, and (3) type of remediation necessary to reduce the risk below the risk level. MAG will provide personnel, services, materials, and equipment required for sampling and analytical support.

## A6.2 TASKS

MAG will provide qualified personnel to perform the following tasks, based on their areas of expertise, during the site investigation:

- Prepare Quality Assurance Project Plan.
- Perform a review of all available data.
- Survey waste piles and estimate the quantity of material in each pile.
- Select sampling locations and collect soil samples for laboratory analysis.
- Prepare samples and ship them to the selected laboratory in Houston, Texas for analysis.
- Perform data validation for quality control.
- Compile and evaluate the data by comparison to the TNRCC Texas Risk Reduction Program Rules (TRRP) levels.
- Provide a written report documenting the sampling and analytical results and recommending further or no further site characterization based on the laboratory analytical results.
- Preparing an engineering report summarizing the findings and recommendations.

The level of concern for potential contamination and the data quality needs will be based on the TCEQ Texas Risk Reduction Program Rules (TRRP). In the final report, MAG will compare the results of the analytical data to the TCEQ TRRP levels to determine whether site contaminants, if present, exceed the risk-based concentrations.

The field sampling activities are scheduled to be conducted in February 2004. Data analysis, interpretation, and report preparation should require approximately 2 months.

## A7 QUALITY OBJECTIVES AND CRITERIA

EPA's data quality objective (DQO) process is a systematic planning tool that is designed to ensure that the measurement data collected are of the type, quantity, and quality that are the most appropriate for supporting the decisions that will be based on these data. This section outlines data categories and discusses DQOs for the City of Galveston Materials Yard.

### A7.1 DATA CATEGORIES

The EPA Superfund program has developed two descriptive data categories—screening and definitive—to assist in interpreting data (U.S. EPA 1993; 1994). The specific type of data to be generated will depend on the qualitative and quantitative DQOs that are developed for a project. For this project, the DQOs require that definitive data, Level III analyses be conducted by using analyses performed by a qualified laboratory. Validation or documentation procedures are not usually as rigorous as those required of CLP Level IV analyses (U.S.EPA 1993).

### A7.2 DATA QUALITY OBJECTIVES

The data quality objective (DQO) process is performed before developing a sampling and analysis plan to ensure that the type, quality, and quantity of data needed to make decisions about a site are appropriate for the project objectives. The DQO process results in a series of DQO statements resulting from an analysis

of a problem at a site, the identification of the type of data to collect, and the identification of acceptable levels of error associated with the data. Based on the project objectives and information known about the site, DQOs were developed for the City of Galveston Materials Yard.

#### **A7.2.1 Description of Problem**

Soil, groundwater, surface water and sediment sampling at the City of Galveston Materials Yard will be conducted to assess the presence and nature of any potential contamination present at the Site. The Site is potentially to be converted into a commercial area, which requires that the soils and the shallow groundwater not contain contamination at levels that would pose an unacceptable threat or risk to human health.

#### **A7.2.2 Decisions That Will Be Made With Sampling Data**

In order to convert the Site into a commercial area, contamination, if present above acceptable risk levels, will need to be remediated. To select and implement a remediation remedy for the site, the type and extent of contamination must be characterized. The sampling data will provide answers to the following questions, which will help characterize the site and allow a remediation remedy to be proposed. Since this investigation will not delineate the full extent of contamination (if present), an accurate cost estimate will not be prepared. Remedy cost on a unit basis will be prepared until such time that the extent is determined.

The Environmental Site Assessment will answer the following questions:

- Is there contamination at the site at levels exceeding human health based commercial risk screening levels?
- Has the shallow groundwater been impacted at levels exceeding human health based commercial risk screening levels?

#### **A7.2.3 Sampling Data Needed to Make Decisions**

It is not known at this time if contamination is present nor is the volume of potentially affected material known. Therefore, the piles of material will be surveyed and approximate volumetric calculations will be made. The various piles of material will be categorized based on visual observations. Environmental samples will be collected using the following techniques:

- Surface soil samples from ground surface to a depth of 2-feet will be collected from the various piles using a hand auger. Sampling locations will be determined after debris volume has been calculated and categorized
- Subsurface soil and groundwater samples will be collected at seven (7) locations (Figure A-3) using a push probe. Two push probe/groundwater sample locations will be collected in the horse pasture (south of the Materials Yard); one push probe/groundwater location will be along the north, east, and west perimeter of the Site.
- Surface water and sediment samples will be collected from two locations (Figure A-3).

Each sample will be analyzed for the following constituents:

- Target Analyte List (TAL) Metals
- Target Compound List Organics (volatile organic compounds & semi-volatile organic compounds)
- Pesticides/PCBs
- Herbicides
- Total Dissolved Solids/Total Suspended Solids (Groundwater samples only)

#### **A7.2.4 Logic Decisions About Contamination**

It is not known if contamination is present or suspected at the City of Galveston Materials Yard.

#### **A7.2.5 Acceptable Levels of Uncertainty About Sampling Data**

Section A7.1 discusses the data category, definitive data that meets Level III analysis, for this project. If the sampling data does not meet the criteria for data quality, the sampling event and analysis will be reevaluated to determine where the process failed. Data will be re-reviewed to determine if any data meets the data quality levels, and either the analysis, sample collection, or both will be re-evaluated and if necessary, repeated to reduce data uncertainty to an acceptable level.

#### **A7.2.6 Sampling Design**

Section B1 discusses sampling design in detail. The sampling event is designed to evaluate areas of potential contamination. The sampling design for this project is not intended to identify the horizontal and vertical extent of contamination, only the presence or absence of contamination.

The DQO process is not complete without a final evaluation of whether DQOs were met, which is conducted after sample collection and analysis has been completed.

### **A7.3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA**

The overall quality assurance objective (QAO) for the project is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and data reporting that will provide results that are legally defensible in a court of law. Other sections of this QAPP describe specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action. The purpose of this section is to discuss specific QAOs for the City of Galveston Materials Yard, including sensitivity, accuracy, precision, completeness, representativeness, and comparability of data.

The following subsections discuss QAOs, including (1) sensitivity of data; (2) accuracy and precision of data; and (3) completeness, representativeness, and comparability of data.

#### **A7.3.1 Sensitivity**

The QA objective for sensitivity is generally expressed in the form of the method detection limit (MDL) or quantitation limit for the analytical method selected. Section B5.7 (Equation B5.9) presents the equation that is used to calculate the MDL.

The required detection limits and quantitation limits for the analytes in a soil matrix are based upon their concentrations of concern. Quantitation limits reflect the influences of the sample matrix on method sensitivity and are typically higher than detection limits. Quantitation limits provide a more reliable indication than detection limits, of the amount of material needed to produce an instrument response that can be routinely identified and reliably quantified in applying a particular analytical method to real environmental samples. The specified analytical method will have matrix-specific quantitation limits that are lower than any contaminant concentrations of concern.

#### **A7.3.2 Accuracy and Precision**

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy is typically expressed as percent recovery (%R) from spiked samples or bias with respect to a reference standard. Using Spiked samples will provide (1) a constant check on method accuracy, and (2) an indication of the degree of matrix effect. Section B4 presents equations that will be used to calculate accuracy in terms of %R.

Accuracy for field sampling will be obtained by following the sampling strategy and SOPs specified in this QAPP and FSP. Accuracy for laboratory analyses will be assessed by collecting and analyzing the following types of QC samples: (1) matrix spike/matrix spike duplicate (MS/MSD) samples, and (2) laboratory QC check samples. MS/MSD samples are collected in the field; other QC check samples that will be used to assess accuracy are prepared in the laboratory. Laboratory check samples include the following:

- Blank spikes
- Calibration blanks
- Independent check standards
- Instrument blanks
- Laboratory control samples
- Method blanks
- Reagent blanks
- Standard reference material
- Surrogate spikes

Precision is a measure of the variability of a measurement system. It is typically estimated by using duplicate and replicate measurements, and is expressed in terms of relative percent difference (RPD). Section B5.4 (Equation B5-1) presents equations that will be used for calculating RPD. For field sampling, precision will be obtained by following SOPs and by using identical sampling procedures to collect all samples. Field QC samples that will be collected to measure precision include duplicate samples. Field measurement precision is generally monitored by taking replicate measurements, and is increased by properly operating and maintaining field equipment. However, no field analyses or measurements will be collected during this work assignment.

Precision for laboratory analyses will be measured by collecting and analyzing the following types of samples: field duplicate samples, MS/MSD samples, and laboratory duplicate samples.

**A7.3.3 Completeness, Representativeness, and Comparability**

Completeness is measured by comparing the amount of valid data obtained from a measurement system to the total number of measurements needed to achieve a specified level of confidence in decision-making. After analytical testing has been completed, the percent completeness will be calculated by using the equation presented in Section B5.8 (Equation B5.8). The completeness objective for laboratory measurements will be 90 percent.

Representativeness expresses the degree to which data accurately and precisely represent (1) a characteristic of a population, (2) parameter variations at a sampling point, (3) a process condition, or (4) an environmental condition. Representativeness is a qualitative parameter that depends on the proper design of the sampling program and the use of proper laboratory protocols. The sampling locations have been selected to provide data that are representative of site conditions.

Representativeness can also be affected by the time, place, and manner of sampling. In many cases, project planners' account for the difficulty in knowing when, where, and how to collect representative samples, as follows:

- Develop statistical or random sampling networks.
- Collect more samples than would otherwise be needed.
- Collect samples at several distinct phases of natural or anthropogenic cycles.
- Collect samples at different locations within the project area.
- Collect composite samples rather than grab samples.
- Verify and validate the sampling techniques in separate studies.

Comparability expresses the confidence with which one portion or set of data can be compared with another. Generally, comparability will be attained by achieving the QA objectives—presented in this QAPP—for sensitivity, accuracy, precision, completeness, and representativeness. Comparability of data will also be achieved by following standard field and laboratory procedures.

**A8 SPECIAL TRAINING REQUIREMENTS OR CERTIFICATION**

The main training requirements for MAG personnel engaged in field activities are the emergency response and hazardous waste operations training requirements defined in Title 29 Code of Federal Regulations (29 CFR) Part 1910.120. MAG personnel meet the specialized training and certification requirements for completing the environmental data collection Tasks described in this QAPP. Further information on MAG's training program is contained in MAG's Corporate Health and Safety Manual.

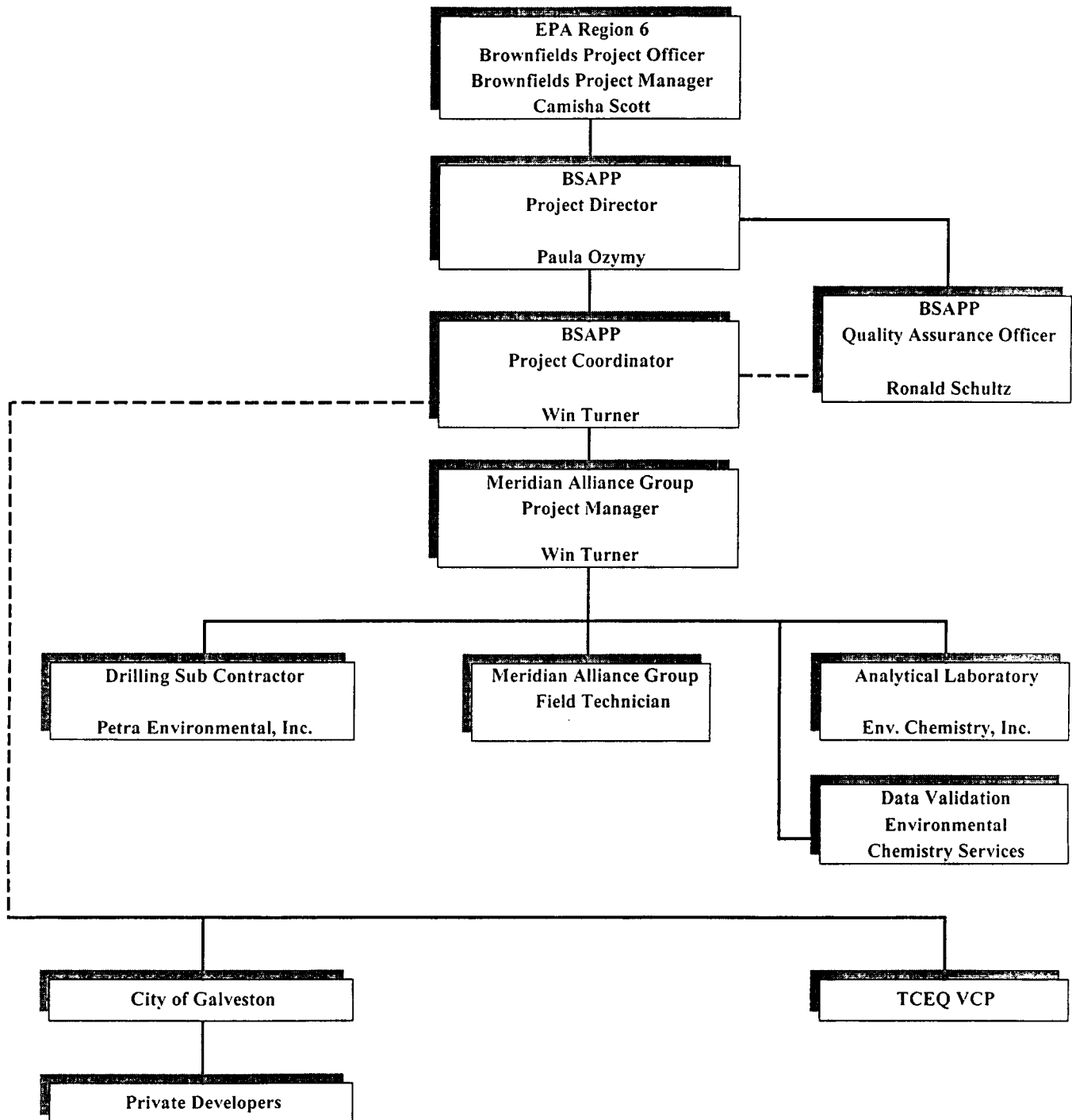
**A9 DOCUMENTATION AND RECORDS**

This section describes the data reporting requirements for MAG field personnel and laboratories that submit field and laboratory measurement data. Sections C and D describe requirements for data validation reports, DQA reports, and other QC reports that MAG prepares or compiles, which are not covered in this section.

The MAG project manager, in cooperation with the QA officer, will define site-specific data reporting requirements. Requests for analytical services will clearly define these requirements, the turn-around-time for receipt of the data deliverables specified, and any requirements for retention of samples and laboratory

records. The laboratory QA manager is responsible for ensuring that all laboratory data reporting requirements in the QAPPs are met.

**FIGURE A-1**  
**Brownfields Site Assessment Pilot Project**  
**City of Galveston, Texas**  
**City of Galveston Materials Yard**  
**Project Organization Chart**



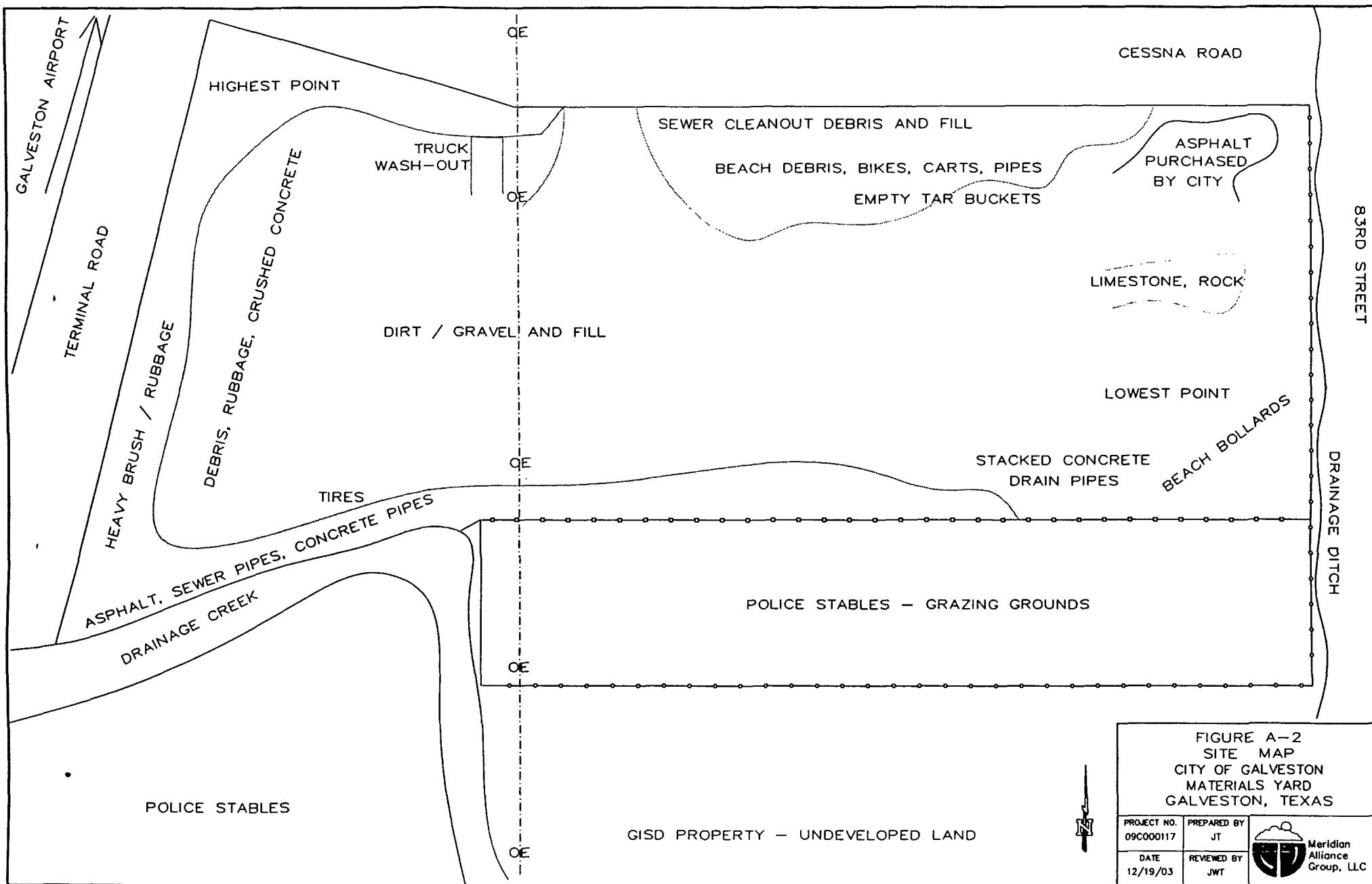

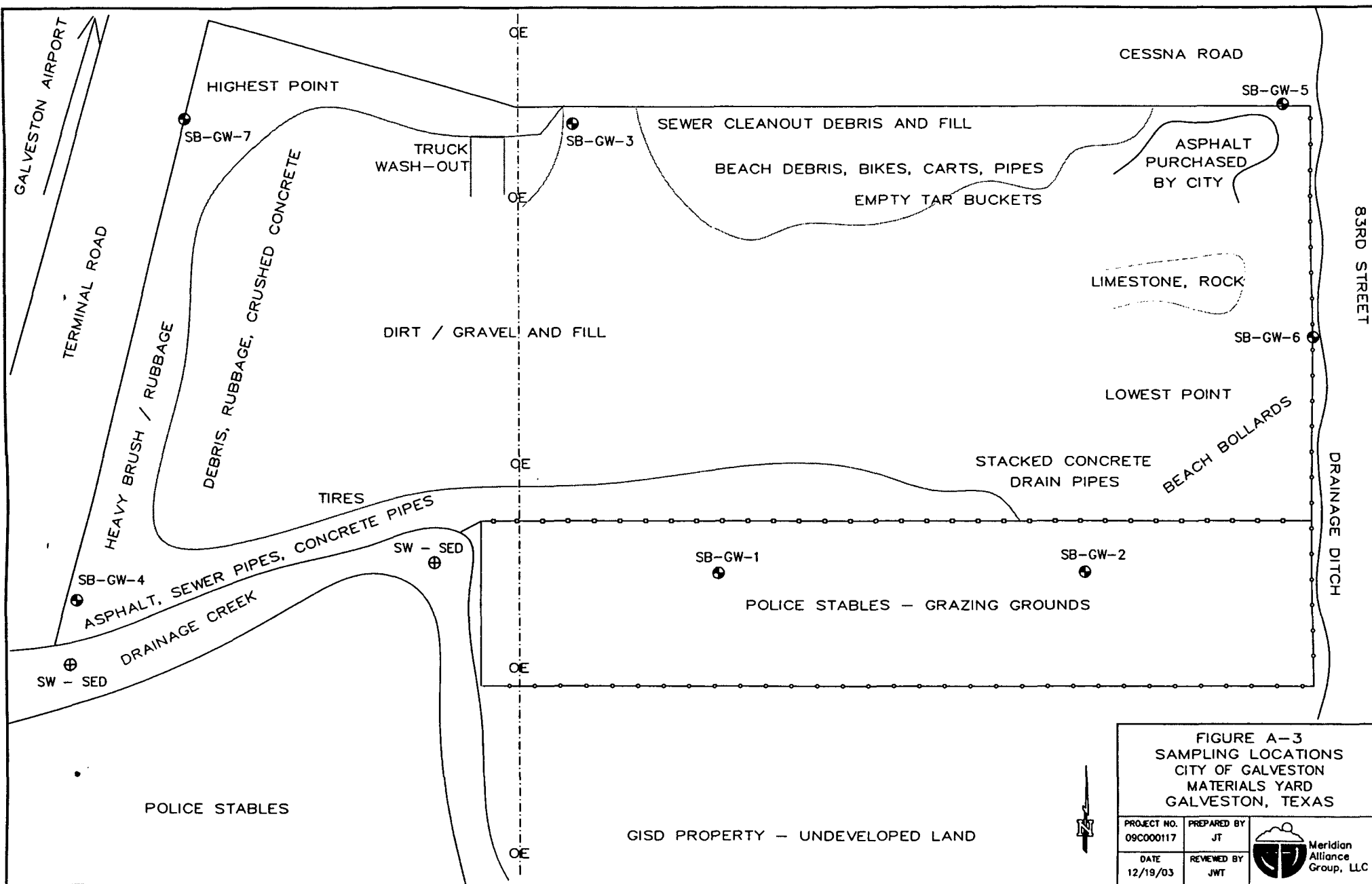
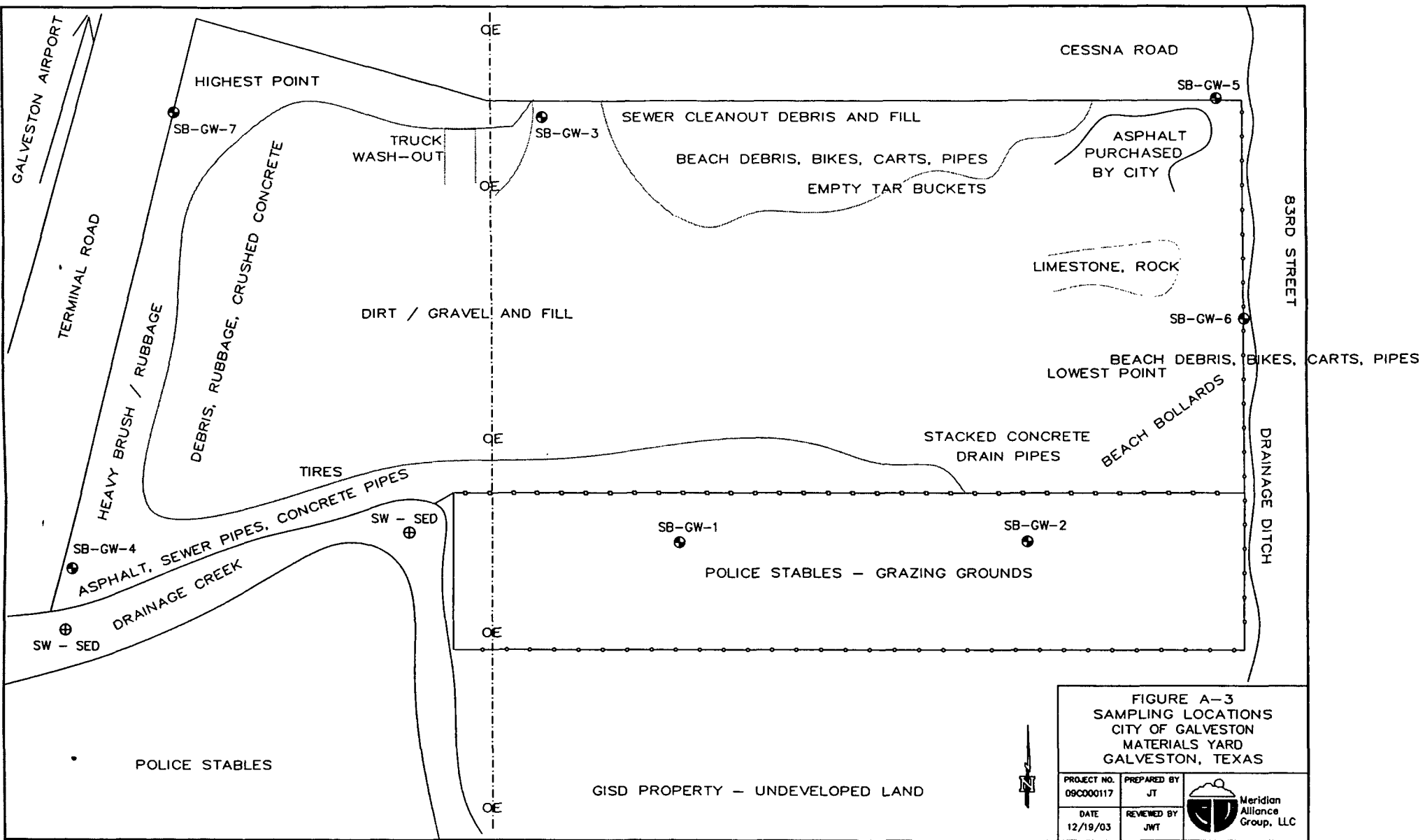


FIGURE A-2  
SITE MAP  
CITY OF GALVESTON  
MATERIALS YARD  
GALVESTON, TEXAS

PROJECT NO. 09C000117	PREPARED BY JT	 Meridian Alliance Group, LLC
DATE 12/19/03	REVIEWED BY JWT	





**FIGURE A-3  
SAMPLING LOCATIONS  
CITY OF GALVESTON  
MATERIALS YARD  
GALVESTON, TEXAS**

PROJECT NO. 09C000117	PREPARED BY JT
DATE 12/19/03	REVIEWED BY JMT

Meridian  
Alliance  
Group, LLC

**B1 SAMPLING PROCESS DESIGN**

The sampling design discussed below represents the field-sampling plan (FSP) for the City of Galveston Materials Yard. For this project, the sampling design, includes

- (1) the numbers and types of samples to be collected,
- (2) sampling locations,
- (3) sampling frequencies,
- (4) sample matrices,
- (5) measurement parameters.

The sampling design is based on DQOs described in Section A7. Section A6 discusses the sampling tasks planned for this project. During the sampling event, MAG will select the exact locations to sample – approximate sampling locations are shown on Figure A-3. MAG may need to modify this FSP if site conditions differ significantly from those originally anticipated.

This QAPP and FSP will be made available to regional, state, and local authorities before sampling work begins at the site. MAG will modify the approach and plan, as necessary, on the basis of input from these entities, and as authorized by EPA.

**B2 SAMPLING METHODS*****Collection of Soil Samples***

Surface soil samples will be collected from various locations determined in the field after surveying and mapping of the debris piles has been conducted. Surface soil samples will be collected using a hand auger from the ground surface to a depth of 2-feet. In the debris piles, if obstructions to hand augering are encountered (concrete, etc.), power augering or excavation may be used to collect the samples.

Subsurface soil samples will be collected using a push probe at 5 locations. The push probe will collect continuous soil samples from ground surface through the uppermost transmissive zone, which is expected to be between 5 to 15 feet below ground surface.

The field procedure for granular soil sampling will be conducted in general accordance with the *Standard Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D 1586). Undisturbed samples of cohesive soils will be collected by hydraulically pushing a 2-inch diameter, thin-walled tube sampler a distance of about 48-inches. The field procedure for cohesive soil sampling will be conducted in general accordance with the *Standard Practice for Thin-Walled Tube Sampling of Soils* (ASTM D 1587).

The samples will be visually classified and boring logs will be prepared.

### *Collection of Groundwater Samples*

Groundwater samples will be collected from the upper-most transmissive zone in the seven borings. Temporary piezometers will be installed through the boring for sample collection.

## **B3 SAMPLE HANDLING AND CUSTODY**

Samples will be collected, labeled, preserved, and shipped under Chain-of-Custody to the laboratories following SOPs contained in Appendix A. All sampling equipment and down-hole equipment will be decontaminated prior to the collection of each sample following SOPs contained in Appendix A.

## **B4 ANALYTICAL METHODS**

Laboratory analyses of samples will be conducted by Environmental Chemistry, Inc. laboratories in Houston, Texas. In all cases, appropriate methods of sample preparation, cleanup, and analyses are based on specific analytical parameters of interest, sample matrices, and required detection limits. EPA and ASTM Methods to be used are provided in SOP-3 (Appendix A).

## **B5 QUALITY CONTROL**

Various types of field and laboratory QC samples and measurements will be used to verify that analytical data meet the QAOs. Field QC samples and measurements will be used to assess how the sampling activities and measurements influence data quality. Similarly, laboratory QC samples will be used to assess how a laboratory's analytical program influences data quality. This section describes the QC samples to be analyzed during the investigation for (1) each field and laboratory environmental measurement method, and (2) each sample matrix type.

This section provides definitions, and typical collection and analysis frequencies, of common field and laboratory QC samples and measurements. It also outlines the procedures used to assess field measurements, laboratory data, and common data quality indicators.

### **B5.1 FIELD QUALITY CONTROL REQUIREMENTS**

Field QC samples will be collected and analyzed to assess the quality of data generated by sampling activities. These samples include field duplicates samples, and MS/MSD samples. Because no field analysis or measurements are planned for this project, no field QC measurements will be taken.

Field duplicate or co-located samples are independent samples collected as close as possible, in space and time, to the original investigative sample. Field duplicate samples can measure the influence of sampling and field procedures on the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. Typically, field duplicate samples are collected at a frequency of one for every 10 investigative samples of the same matrix type. Immediately following collection of the original sample, the field duplicate sample will be collected by using the same collection method. Care will be taken to collect the field duplicate sample as close as possible to the location of the original sample.

MS/MSD samples require double or triple extra volume, depending on analytical laboratory specifications. MS samples are typically collected for analysis by inorganic methods. Each MS sample is

one sample, usually collected from one location at double the normal sample volume. MS/MSD samples are collected for organic analytes. In the laboratory, MS/MSD samples and MS samples are split and spiked with known amounts of analytes. Analytical results of MS/MSD samples are used to measure the precision and accuracy of the laboratory organic analytical program. Each of these QC samples is typically collected and analyzed at a frequency of one for every 20 investigative samples per matrix.

Two soil field duplicates will be collected and 1 matrix spike and 1 matrix spike duplicates will be collected for analysis. One duplicate and one matrix spike and one matrix spike duplicate sample will be collected along with the seven groundwater samples.

## **B5.2 LABORATORY QUALITY CONTROL REQUIREMENTS**

The laboratory that will perform the analytical work under this project will adhere to a QA program that is used to monitor and control all laboratory QC activities. The laboratory has a written QA manual that describes the QA program in detail. The laboratory QA manager is responsible for ensuring that all laboratory internal QC checks are conducted in accordance with the SW-846 methods, and the laboratory's QA manual.

Many of the laboratory QC procedures and requirements are described in EPA-approved analytical methods, laboratory method SOPs, and method guidance documents. For example, when laboratory analyses are conducted in accordance with SW-846 methods, QC procedures and requirements specified in the methods will be followed exactly. However, if laboratory QC requirements are not specified in an analytical method, or requirements beyond those included in an analytical method are necessary to ensure that project QA objectives and DQOs are met, MAG will request that the following information be included in the data package:

- Laboratory analytical methods to which the internal QC check applies
- Complete procedures for conducting the internal QC check
- QC samples and QC measurements involved in the internal QC check
- Complete collection and preparation procedures for the QC samples
- Spiking analytes and concentrations
- Control limits for the internal QC check
- Corrective action procedures to be followed if the internal QC check is not performed properly or results are outside control limits

Laboratory QC procedures and requirements may include the preparation and analysis of laboratory control samples, method blanks, MS and MS/MSD samples, surrogate spikes, and standard reference materials or independent check standards. The following subsections discuss QC checks that are most frequently required.

**B5.2.1 Laboratory Control Samples**

Laboratory control samples are thoroughly characterized, laboratory-generated samples that will be used to monitor the laboratory's day-to-day performance of analytical methods. Laboratory control samples can include laboratory duplicate samples, surrogate spikes, and method blanks. The results of laboratory control sample analyses are compared to well-defined laboratory control limits to determine whether the laboratory system is in control for the particular method. If the system is not in control, corrective action will be implemented. Appropriate corrective actions include (1) stopping the analysis; (2) examining information concerning instrument performance or sample preparation and analysis; and (3) determining whether samples will be re-prepared or reanalyzed.

**B5.2.2 Method Blanks**

Method blanks, which are also known as analytical process or preparation blanks, are analyzed to assess the level of background interference or contamination in the analytical system and the level that may lead to the reporting of elevated concentration levels or false-positive data. Typically, one method blank is analyzed for every 20 samples processed by the analytical system. For batches smaller than 20 samples, one method blank is analyzed with every batch of samples processed.

A method blank consists of reagents, specific to the analytical method, that are carried through every aspect of the analytical procedure, including sample preparation, cleanup, and analysis. The results of the method blank analysis are evaluated, in conjunction with other QC information, to determine the acceptability of the data generated for that batch of samples. Ideally, the concentration of target analytes in the method blank will be below the reporting limit for that analyte. For some common laboratory contaminants, a higher concentration may be allowed.

If the blank for any analysis is beyond control limits, the source of contamination will be investigated, and appropriate corrective action will be taken and documented. Investigation includes an evaluation of the data to determine the extent of the contamination and its effect on sample results. If a method blank is within control limits but indicates concentrations of analytes that are above the reporting limit, an investigation will be conducted to determine whether any corrective action could eliminate an ongoing source of target analytes.

Reporting limits for metals analyses are typically near instrument detection limits (IDL), and the concentrations of the target analytes in the blank must be below the reporting limit. If the blank value for a target analyte is below the reporting limit, the analyte will be reported with no data qualifier flag on the associated sampling data. If the blank value is between the reporting limit and two times the reporting limit, the analyte in the associated samples will be reported with a data qualifier flag to indicate that (1) contamination was present in the blank, or (2) the sample will be re-prepared and reanalyzed if project objectives require this action. A blank containing concentrations of an analyte or analytes that are above two times the reporting limit is considered unacceptable unless (1) the lowest concentration of the analyte in the associated samples is at least 10 times the blank concentration, or (2) the concentrations of the analyte in all samples associated with the blank are below the reporting limit.

### B5.2.3 Matrix Spikes and Matrix Spike Duplicates

An MS is an environmental sample to which known concentrations of all target analytes have been added. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. If there are many target analytes, they will be divided into two to three spike standard solutions. Each spike standard solution will be used alternately. The MS, in addition to an un-spiked aliquot, will be taken through the entire analytical procedure, and the recovery of the analytes will be calculated. Results will be expressed in terms of %R.

An MS/MSD is an environmental sample that is divided into two separate aliquots, each of which is spiked with known concentrations of target analytes. The two spiked aliquots, in addition to an un-spiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results will be expressed as RPD and %R, and compared to control limits that have been established for each analyte. If results fall outside control limits, corrective action will be performed. Typically, one MS/MSD is analyzed for every 20 investigative samples that are prepared in one batch.

### B5.3 COMMON DATA QUALITY INDICATORS

This section describes how QAOs for precision, accuracy, completeness, and sensitivity are measured, calculated, and reported.

### B5.4 PRECISION

Comparing analytical results of MS/MSD sample pairs for organic analyses, field duplicate samples, field-split samples, laboratory duplicate samples, and replicate measurements assesses precision of many analyses. If it is calculated from two measurements, precision is normally measured as RPD, as in the following equations:

$$RPD = \frac{(C_1 - C_2) \times 100}{(C_1 + C_2) / 2} \quad (B5-1)$$

where

RPD = relative percent difference  
 $C_1$  = larger of the two observed measurement values  
 $C_2$  = smaller of the two observed measurement values

$$RSD = (s/r) \times 100\% \quad (B5-2)$$

where

RSD = relative standard deviation  
 $s$  = standard deviation  
 $r$  = mean or replicate analyses

Standard deviation ( $s$ ) is defined as follows:

$$s = \sqrt{\sum_{i=1}^n \frac{(y_i - r)^2}{n - 1}} \quad (\text{B5-3})$$

where

s	=	standard deviation
y <sub>i</sub>	=	measured value of the ith replicate
r	=	mean or replicate measurement
n	=	number of replicates

For field measurements such as pH, for which the absolute variation is more appropriate, precision is often reported as the absolute range (D) of duplicate measurements:

$$D = |m_1 - m_2| \quad (\text{B5-4})$$

where

D	=	absolute range
m <sub>1</sub>	=	first measurement value
m <sub>2</sub>	=	second measurement value

## B5.5 ACCURACY

The accuracy of many analytical methods is assessed by using the results of MS/MSD samples, laboratory control samples, standard reference materials, independent check standards, and measurements of instrument responses against zero and span gases. For measurements in which spikes are used, %R is often calculated as a measure of accuracy, as follows:

$$\% R = 100 \times \left[ \frac{(S - U)}{C_{sa}} \right] \quad (\text{B5-5})$$

where

%R	=	percent recovery
S	=	measured concentration in spiked aliquot
U	=	measured concentration in unspiked aliquot (usually equals zero for surrogate spikes)
C <sub>sa</sub>	=	actual concentration of spike added

When a standard reference material is used, the following equation is often used to calculate %R:

$$\% R = 100 \times \left[ \frac{C_m}{C_{srn}} \right] \quad (\text{B5-6})$$

where

%R	=	percent recovery
C <sub>m</sub>	=	measured concentration of standard reference material
C <sub>srn</sub>	=	actual concentration of standard reference material

For field measurements, such as pH, accuracy is often expressed in terms of bias and is calculated as follows:

$$B = M - A \quad (\text{B5-7})$$

where

B	=	bias
M	=	measured value of standard reference material
A	=	actual value of standard reference material

## B5.6 COMPLETENESS

For most measurements, completeness is calculated as follows:

$$\%C = 100\% \left[ \frac{V}{n} \right] \quad (B5-8)$$

where

%C	=	percent completeness
V	=	actual number of measurements judged valid (the validity of a measurement result is determined by judging its suitability for its intended use)
n	=	total number of measurements planned to achieve a specified level of confidence in decision making

## B5.7 SENSITIVITY

The achievement of MDLs depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure data quality and to ensure that analyses meet the QA objectives established for sensitivity in the project-specific QAPP. Method sensitivity is typically evaluated in terms of the MDL and, for many measurements, is calculated as follows:

$$MDL = t_{(n-1, 1-\alpha=0.99)} S \quad (B5-9)$$

where

MDL	=	method detection limit
$t_{(n-1, 1-\alpha=0.99)}$	=	student's t-value for a one-sided 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom
n	=	number of measurements
$\alpha$	=	statistical significance level
s	=	standard deviation of the replicate analyses

## B6 INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

This section outlines testing, inspection, and maintenance procedures for (1) field equipment and instruments and (2) laboratory instruments. No field-testing equipment will be used for the City of Galveston Materials Yard. This section discusses general requirements that apply to laboratory equipment.

## B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Testing, inspection, and maintenance methods and frequency will be based on (1) the type of instrument; (2) its stability characteristics; (3) the required accuracy, sensitivity, and precision; (4) its intended use,

considering project-specific DQOs; (5) manufacturer's recommendations; and (6) other conditions affecting measurement or operational control. For most instruments, preventive maintenance is performed in accordance with (1) procedures and schedules recommended in the instrument manufacturer's literature or operating manual, or (2) SOPs associated with particular applications of the instrument.

In some cases, testing, inspection, and maintenance procedures and schedules will differ from the manufacturer's specifications or SOPs. This can occur when the analytical methods associated with a laboratory instrument require more frequent testing, inspection, and maintenance.

### **B7.1 LABORATORY INSTRUMENTS**

All laboratories conducting analyses of samples are required to have a preventive maintenance program covering (1) testing, inspection, and maintenance procedures, and (2) the maintenance schedule for each measurement system and required support activity. This program is usually documented, in the form of SOPs, for each analytical instrument to be used. It will generally be laboratory-specific, but it will follow requirements outlined in the EPA-approved guidelines. Basic requirements and components of such a program include the following:

- Each laboratory will conduct, as a part of its QA/QC program, a routine preventive maintenance program to minimize instrument failure and other system malfunction.
- Instruments, equipment, tools, and gauges will be maintained and repaired by an internal group of qualified personnel. Alternatively, scheduled instrument maintenance and emergency repair may be provided by manufacturers' representatives under a repair and maintenance contract.
- The laboratory will maintain instruments on a regular schedule. Servicing of critical items will be scheduled to minimize the downtime of the measurement system. The laboratory will prepare a list of critical spare parts for each instrument. These spare parts will be requested from the manufacturer and stored at the laboratory.
- Testing, inspection, and maintenance procedures described in laboratory SOPs will be in accordance with *manufacturer's specifications and with the requirements of the specific analytical methods used.*
- All maintenance and service will be documented in service logbooks to provide a history of maintenance records. A separate service logbook will be kept for each instrument. All maintenance records will be traceable to the specific instrument, equipment, tool, or gauge.
- Records produced as a result of testing, inspection, or maintenance of laboratory instruments will be maintained and filed at the laboratory. These records will be available for review, by internal and external laboratory system audits.

## **B7.2 INSTRUMENT CALIBRATION AND FREQUENCY**

This section describes the procedures for maintaining the accuracy of laboratory instruments used for analyses. The equipment and instruments will be calibrated before each use and, when not in use, on a periodic schedule.

All laboratory equipment used to analyze samples is calibrated on the basis of written SOPs maintained by the laboratory. Calibration records (including the dates and times of calibration, and the names of the personnel performing the calibration) will be (1) filed at the location at which the analytical work is performed, and (2) maintained by the laboratory personnel performing QC activities. Calibration records will be subject to QA audits. The laboratory QA manager is responsible for ensuring that all laboratory instruments are calibrated in accordance with the requirements of this QAPP.

The laboratory will follow the method-specific calibration procedures and requirements for laboratory measurements. Calibration procedures and requirements will also be conducted, as appropriate, for laboratory support equipment, such as balances, mercury thermometers, pH meters, and other equipment used to take chemical and physical measurements.

## **B8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

MAG project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed for environmental data collection projects. The project manager is also responsible for determining acceptance criteria for these items.

Supplies and consumables will be received in the field. When supplies are received, the MAG project manager or field team leader will—before the supplies are accepted for use on the project—sort the supplies by vendor, check packing slips against purchase orders, and inspect the condition of all supplies. If the supplies do not meet the acceptance criteria, deficiencies will be noted in the field logbook. In addition, a form will be completed, describing the problem and circumstances in full and noting the purchase order number of the item. The item will then be returned to the vendor for immediate replacement or repair.

## **B9 NON-DIRECT MEASUREMENTS**

Non-direct measurements were used in the development of the Phase I ESA. These included aerial photographs, personal interviews, and database searches (see Phase I ESA report).

## **B10 DATA MANAGEMENT**

All files and records will be maintained at MAG's office in Galveston, Texas under the direct supervision of the Project Coordinator.

- Field notes will be contained in a bound logbook – copies will be made daily and kept in a separate file.
- Chain-of-Custody records will accompany all samples; carbon copies will be kept at the MAG office along with courier records.
- Reports will be maintained in electronic format (Microsoft Word, Microsoft Excel, and AutoCAD) on MAG's computer network. Backup CD's will be made of all records.

- Data deliverables from the laboratory and data validation process will be kept on file at MAG's Galveston office for a minimum of 5-years.
- Data spreadsheets will be developed in Microsoft Excel – All data entry are double checked by separate individuals from the data entry person.
- Photographs and drawings will be maintained on CD's with additional backup copies.

MAG's record keeping and Data Management programs are consistent with the applicable Agency data management requirements.

## **C1 ASSESSMENT AND RESPONSE ACTIONS**

Performance and system audits of field and laboratory activities may be conducted to verify that sampling and analysis are performed in accordance with the procedures and requirements established in the QAPP. This includes the following:

- Performance and system audits
  - Audit personnel
  - Audit scope of work
  - Audit frequencies
  - Audit reports
- Corrective action
  - Sample collection and field measurements
  - Laboratory analyses
  - Data Validation

Project coordination and oversight will be by the BSAPP project coordinator, Mr. J. W. Turner. All field activities including environmental sampling will be conducted under the direct supervision of MAG's project manager, Mr. J. W. Turner. Mr. Turner will be responsible for quality oversight, including the authority to issue stop work orders, to those under their chain-of-command (see Figure A-1). Analytical testing will be managed by Ms. Nan Tome at Environmental Chemistry, Inc. Ms. Nan Toole of Environmental Chemistry Services will be responsible for data quality validation of the environmental analytical results.

## **C2 REPORTS TO MANAGEMENT**

All environmental data and conclusions will be presented in a final report prepared by MAG to be submitted to the City of Galveston and EPA. MAG will also give the City of Galveston an oral summary of the findings, with recommendations and conclusions on environmental status, development potential and obstacles, and recommendations for future actions.

**D1 DATA REVIEW, VERIFICATION, AND VALIDATION**

Data reduction and review are essential functions for preparing data that can be used effectively to support project decisions and DQOs. These functions will be performed accurately and in accordance with EPA-approved procedures and techniques. Data reduction includes all computations and data manipulations that produce the final results used during the investigation. Data review includes all procedures conducted by laboratory personnel to ensure that measurement results are correct and acceptable in accordance with the QA objectives stated in this QAPP.

**D2 VERIFICATION AND VALIDATION METHODS**

Field personnel will record, in a field logbook, all raw data from field procedures. The MAG project manager has primary responsibility for (1) confirming that sample collection and handling procedures specified in this QAPP are followed, and (2) ensuring that all field data reduction and review procedures requirements are followed. He is also responsible for assessing preliminary data quality and for advising the data user of any potential QA/QC problems with field data. When field data are used in a project report, data reduction methods will be fully documented in the report.

Laboratory measurement data reduction and review procedures and requirements are specified in laboratory methods, SOPs, and guidance documents.

The laboratory will conduct data reduction for chemical and physical laboratory measurements, and will conduct an in-house review of all laboratory analytical results. The laboratory QA manager is responsible for ensuring that all laboratory data reduction and review procedures follow the requirements stated in the methods. The QA manager is also responsible for assessing data quality and for advising the BSAPP/MAG QA officer of possible QA/QC problems with the laboratory data. All analytical data will be validated in accordance with requirements specified in the EPA National Functional Guidelines by a data validation consultant independent of the laboratory.

**D3 RECONCILIATION WITH USER REQUIREMENTS**

The main purpose of a QA system is to define a process for collecting data that are of known quality, are scientifically valid, are legally defensible, and fully support any decisions that will be based on the data. The QAPP requires that DQOs, to achieve this purpose, be fully defined in Section A7. All other parts of the QA system will then be planned and implemented in a manner consistent with the DQOs. QA system components that follow directly from the DQOs include (1) documentation and reporting requirements (Section A9); (2) sample network design and sampling methods (Sections B1 and B2); (3) analytical methods and analytical service requests (Section B4); (4) QC requirements (Section B5); and (5) data reduction, validation, and reporting methods (Sections D1 and D2).

After environmental data have been collected and reviewed, the data will be further evaluated to determine whether the DQOs specified in the QAPP have been met. MAG will follow EPA's DQO process to verify that the data collected are of the type, quality, and quantity that are appropriate for their intended use. The DQO process involves first verifying that the assumptions under which the data collection design and DQOs were developed have been met, and taking appropriate corrective action if the assumptions have not been met. The DQO process then evaluates how well the data collected support the decision that must be made so that scientifically valid and meaningful conclusions can be drawn from

the data. To the extent possible, MAG will follow DQO methods and procedures outlined by EPA (U.S. EPA 1996b).



## **APPENDIX A**

# **Standard Operating Procedures**

## STANDARD OPERATING PROCEDURES

SOP-1 and SOP-2 describe the specific requirements and procedures for collecting different environmental sample types (i.e., grab vs. composite, soil vs. groundwater, etc.). Care has been taken to establish the best practical sampling procedure that will result in obtaining representative samples. The samples must maintain the integrity of the original medium through collection, transportation and delivery to the analyst.

SOP - 3 outlines the required sample containers, preservation of samples, and holding times for the various types of environmental samples.

SOP - 4 describes decontamination procedures.

All field data will be recorded in a bound logbook, on appropriate forms, and on individual sample labels. A photograph log will also be maintained of all field activities. These items will remain under control of the project manager at all times.

**SOP 1**  
**GROUNDWATER SAMPLING**  
**[Organic, Inorganic, Phase Separated Hydrocarbons]**

The subsurface is a unique heterogeneous environmental. Gas exchange, biological and other chemical reactions and conditions are different from the surface environment. Groundwater is somewhat insulated from surface temperature and pressure variations. Rapid and significant changes can occur in groundwater samples upon exposure to the surface (i.e., sunlight, temperature and pressure). Therefore, groundwater sampling is conducted in a manner to minimize interaction of the sample and the surface environments. The equipment and protocol for collection of groundwater samples is discussed in the following paragraphs.

**Sampling Equipment:** Many variations of groundwater sampling equipment are available depending upon the objective of the sampling program. Generally, groundwater samples collected from monitoring wells are obtained using either dedicated or disposable Teflon bailers. This eliminates the potential for cross-contamination and the need for equipment decontamination. Temporary piezometers are sampled using a peristaltic pump with disposable Teflon tubing.

**Sampling Protocol – Monitoring Wells:** Groundwater sampling protocol is as follows:

Measure Water Level - Using a clean electronic level indicator or interface probe measure and record the static water level in the monitoring well. If phase separated hydrocarbons (PSH) are detected, the product thickness will also be recorded. The probe will then be lowered to the bottom of the monitoring well and the total depth recorded. The fluid well volume in the screen and riser will be calculated using the formula listed below:

$$\pi r^2 h = \text{cubic feet of water}$$

Where: r = inside radius of the monitoring well

h = total feet of fluid

$$0.13368 \text{ ft}^3/\text{gal}$$

The water level probe or interface probe shall be thoroughly decontaminated between each monitoring well measurement.

**Purge Monitoring Well** - Monitoring wells that do not contain PSH will be purged as follows: Evacuate three (3) to five (5) well volumes of groundwater using the submersible well wizard pump. The groundwater will be collected in a truck mounted 350-gallon high-density polyethylene (HDPE) tank for disposal or in 55 gallons steel drums. When the groundwater is relatively clear, the pump shall be removed from the well and thoroughly decontaminated. The purged groundwater shall be disposed of appropriately.

Monitoring wells that contain PSH will not be purged.

**Collect Sample - PSH** - Monitoring wells that contain PSH will be sampled as follows: Lower clean Teflon tubing into the PSH interval. Using a peristaltic pump, collect sample of PSH for organic analysis (BTEX, TPH, PAH, & MTBE). Groundwater samples will not be collected.

**Collect Sample Groundwater** - The monitoring wells shall be sampled no sooner than 1 hour after purging and no later than 8 hours after purging. Groundwater samples will be collected by gently lowering the Teflon bailer into the well until it contacts the water surface. Allow the bailer to sink to the desired depth (i.e., within the screened interval), and fill with a minimum of surface disturbance. Care will be taken so that the sample is collected from the screened portion of the well and not from the overlying riser section or the underlying sand-sump section of the well. Slowly withdraw the bailer, being careful to prevent contact of the bailer line with the ground. Tip the bailer and slowly discharge the contents into the appropriate container. The process will be repeated as necessary to fill each container to the required volume. Samples to analyzed for volatile organics will collected first to minimize the effect of disturbance of the water surface in the well on the volatile analysis. Sample containers will be filled completely leaving no air space above the liquid portion to minimize volatilization. Groundwater samples to be analyzed for dissolved metals will be filtered in the field through a filter membrane with 0.45 micron pore size.

**Sampling Protocol – Temporary Piezometers:** Groundwater sampling protocol is as follows:

New Teflon tubing, attached to a battery operated peristaltic pump, will be inserted into the screened portion of the temporary piezometer. The pump will be operated at the lowest speed to collect the volatile organic compound sample first.

**Sample Preservation** - All of the samples will be stored and shipped on ice to maintain the temperature at approximately 4°C. Additional sample preservation methods required by specific analyses are identified in SOP 3. Water samples to be analyzed for metals will be checked to ensure that the pH is less than 2.

**Sample Labeling** - Once the sample is collected, label each container providing the following data: sample identification number, project number, date, time, person sampling, intended chemical analysis, the preservative(s) added. Record the information in the bound field notebook and complete all chain-of-custody and request for analysis documents. The bound field notebook will have pre-numbered pages and entries will be indelible ink.

**Custody, Handling and Shipping** - Place the properly labeled sample bottle in the appropriate carrying container and maintain the sample at 4°C throughout the sampling and transportation periods. The lid of the shipper will be taped shut with the custody seals provided with each sample shipper. Samples are shipped on the day collected from the site directly to the laboratory by overnight courier or are picked up by the laboratory on collection day. Chain-of-custody and request for analysis documents are shipped in airtight plastic bags in each container (taped to the inside of the lid) with applicable samples.

## SOP 2

### SOIL SAMPLING

Split-spoon sampling, continuous sampling, and hand auger sampling techniques are generally used to collect soil samples. The following sections present a discussion of equipment, procedures, and protocol for soil sampling. Each piece of sampling equipment will be steam-cleaned before use to minimize potential cross-contamination.

**Split-Spoon and Continuous Sampling Protocol** - The procedures for collecting soil samples with the hollow-stem auger and split-spoon sampler or continuous sampler will be as follows:

**Collect sample** - Soil samples are collected from the boring using a split-spoon sampler or continuous CME or push probe sampler at the specified depth intervals. The sampling equipment will be decontaminated between each sample collection location. Transfer the sample into an appropriate sample container. After the boring is completed, steam clean all of the drilling equipment to prevent cross-contamination. Samples to analyzed for volatile organic compounds will be removed from the sampler first. The sample will be disturbed as little as possible to minimize volatilization of organic compounds. The remainder of the sample will be placed in a stainless steel mixing bowl. The soils will be mixed thoroughly before containerizing the samples.

**Sample Preservation** - All of the samples will be stored and shipped on ice to maintain the temperature at approximately 4°C.

**Sample Labeling** - Once the sample is collected, label each container providing the following data: sample identification number, project number, date, time, person sampling, intended chemical analysis, the preservative(s) added. Record the information in the bound field notebook and complete all chain-of-custody and request for analysis documents. The bound field notebook will have pre-numbered pages and entries will be made in indelible ink.

**Custody, Handling and Shipping** - Place the properly labeled sample bottle in the appropriate carrying container and maintain the sample at 4°C throughout the sampling and transportation periods. The lid of the shipper will be taped shut with the custody seals provided with each sample shipper. Samples are shipped on the day collected from the site directly to the laboratory by overnight courier or are picked up

by the laboratory on collection day. Chain-of-custody and request for analysis documents are shipped in airtight plastic bags in each container (taped to the inside of the lid) with applicable samples.

### SOP 3 SAMPLE CONTAINERS

Samples for chemical analysis will be collected and placed in laboratory provided containers. Appropriate containers for the media and constituents under investigation are identified in the following table. All container caps will have Teflon liners. Vials for volatile organic samples will have Teflon lined septa. Each container will be labeled, giving the sample identification number, date, time, requested analysis, name of sampler, project name and number, and preservative(s).

#### WATER SAMPLES

Parameter	Method	Container	Preservative	Holding Time
Volatile Organics	EPA-8240	(3) 40 ml vials - teflon septum zero head-space	HCl and 4°C	14 days
Semivolatile Organics	EPA-8270	(1) 1-L Amber	4°C	7 ext./40 day after ext.
TAL Metals	EPA-6010	(1) 1-L HDPE	HNO <sub>3</sub> , pH<2	6-months (Mercury 28 days)
Pesticides	EPA-8080	(1) 1-L Amber	4°C, pH 5-9	7 ext./40 day after ext.
Herbicides	EPA-8150	(1) 1-L Amber	4°C	7 ext./40 day after ext.
PCBs	EPA-8080	(1) 1-L Amber	4°C	7 ext./40 day after ext.
TDS	EPA-160.2	(1) 250 ml HDPE	4°C	7 days
TSS	EPA-160.1	(1) 250 ml HDPE	4°C	7 days

#### SOIL SAMPLES

Parameter	Method	Container	Preservative	Holding Time
Volatile Organics	EPA-8240	4 oz. cwm zero head-space	4°C	14 days
Semivolatile Organics	EPA-8270	16 oz. cwm	4°C	7 ext./40 day after ext.
TAL Metals	EPA-6010	8 oz. cwm	NONE	6-months (Mercury 28 days)
Pesticides	EPA-8080	8 oz. cwm	4°C	7 ext./40 day after ext.
Herbicides	EPA-8150	8 oz. cwm	4°C	7 ext./40 day after ext.
PCBs	EPA-8080	8 oz. cwm	4°C	7 ext./40 day after ext.

#### GEOTECHNICAL SAMPLES

Moisture Content	ASTM D 2216		Atterberg Limits	ASTM D 4318
Sieve Analysis	ASTM D 1140		Unconsolidated-Undrained	ASTM D 2850
% Passing No. 200 Sieve	ASTM D 1140		Triaxial Compression	

## SOP 4

### DECONTAMINATION PROCEDURES

All drilling and sampling will be performed in a manner to minimize the unnecessary contact of contamination with field personnel and equipment. Decontamination has two primary goals: to prevent the spread of contamination to non-contaminated areas, and to prevent cross-contamination of samples collected for chemical analysis. The following sections discuss decontamination procedures for field equipment.

#### **Drilling Equipment Decontamination**

The drill head assembly, table and tools will be steam-cleaned between each boring. Gross contamination adhering to the augers, drill head assembly or drill rig will be manually removed with a shovel or trowel, and stored in the drums with the drill cuttings from the corresponding boring. High-pressure steam will be used to wash the drilling equipment. Wash/rinse water will also be collected and drummed.

#### **Sampler Decontamination**

Stainless steel split spoons and core barrels used to collect soil samples for chemical analysis will be decontaminated prior to collecting each soil sample. The following protocol will be followed for decontamination:

- Wash gross contamination away with water
- Wash with Alconox soap
- Rinse with deionized water
- Rinse with Methanol (if sampling for organics)
- Allow to air dry

All associated sampling equipment (spoons, bowls, spatulas, etc.) will be decontaminated before and after each use following the same procedure. In addition to the sampling equipment, any instrument inserted into a boring or a monitoring well will be decontaminated following the same procedure before

and after use. This equipment includes such instruments as the development pump, geophysical probe, water level indicator, or an interface probe.